REMARKS

By this amendment, claims 1-8 have been revised, claims 9-12 have been canceled, and claims 13-20 are added to place this application in condition for allowance. Currently, claims 1-9 and 13-20 are before the Examiner for consideration on their merits.

In review, claims 5-8 have been revised to be in independent form. This change was made in response to the rejection based on 35 U.S.C. § 112, second paragraph and the problem with the use of "consisting of" in the independent claims and the addition of other alloying elements in the dependent claims. This problem is overcome since each of claims 5-8 stand alone, and there is no indefiniteness in the amended claims. It is noted that claims 3 and 4 were rejected for the same reason. However, these claims are independent claims and they are not believed to suffer from the same problems as claims 5-8 and the rejection is believed to be in error in this regard.

It should also be noted that claims 3-8 are revised to group the recitation of the alloying elements together, with the formula, recited hardness and level of carbides following the alloying elements.

To review, claims 1 and 2 relate to the base composition, with claims 3 and 4 including at least one of Ti, V, and Nb with the base composition. Claims 5-8 combine the elements of B, CA, Mg, and rare earth elements with each of claims 1-4.

New claims 13-20 are added as well. These claims parallel claims 1-8 but require the presence of Mo and further define the effect of the amounts of Cu and Mo in terms of the formation of a sulfide layer on a formed chromium oxide layer when the steel is subjected to a sulfur-containing environment. Support for this amendment may be found on page 5, lines 20-25. As a result of the addition of claims 13-20, claims 9-12 became moot and are canceled. The new claims also define a structure as a result of the processing of the material, and support for this amendment may be found on pages 14 and 15.

Turning now to the rejection of the claims, claims 1 and 2 stand rejected under 35 U.S.C. § 103(a) based on United States Patent No. 2,799,602 to Lena.

Claims 3-8 are rejected based on the combination of Lena and the Metallographer's Guide.

Applicants contend that the applied prior art does not establish a *prima facie* case of obviousness against claims 1-4 and 13-16 and the rejection should be withdrawn in favor of an allowance of this application.

The arguments in support of the patentability of the claims are set forth below under the headings of the INVENTION, and the CLAIMS being argued as patentable.

INVENTION

The invention is best understood when taken in the context of the problems of the prior art. As explained in the background art section of the application, 13% Cr steels are commonly used in corrosive oil well operations and initially had to exhibit good corrosion resistance in wet CO_2 environments.

However, this corrosion resistance was not satisfactory once the oil well operations included the presence of sulfur-containing environments, i.e., H_2S, wherein the presence of sulfur caused sulfide stress corrosion cracking.

Efforts were made to improve the performance of 13% Cr steels in these sulfur environments, but limitations on the achievable level of hardness were still present, see page 2, lines 4-13. Compositional changes were proposed involving the addition of nickel and molybdenum or copper. However, as explained on page 2, line 25 to page 3, 8, the prior art 13% Cr steels were still not able to function effectively in both wet CO_2 and H_2S environments.

The invention of this application is a solution to the problems faced by the prior art, and much more than tweaking the teachings of Lena. The inventors have developed a martensitic stainless steel through composition and processing control that exhibits better hardness than that attained in the prior art, and better resistance to sulfide stress corrosion cracking.

This is accomplished in a number of ways as explained in page 5, line 14 to page 6, line 14. In one way, the mixture of Cu sulfide and Mo sulfide, which generates by adding Cu and Mo in combination, forms a tight film onto the film of Cr oxides so as to protect the Cr oxide film.

Secondly, the processing of the steel as a hot-finished or as quenched condition results in hardly any $M_{23}C_6$ carbides. With this state, the precipitation of $M_{23}C_6$ type carbides is suppressed by eliminating the typical tempering treatment.

Lastly, the hardness is in a range that improves the corrosion resistance.

The processing referenced above involves one of three scenarios:

a) after hot rolling, wherein subsequent to heating to the temperature of Ac_3 point or more, the quenching treatment or air cooling is carried out;

b) the steel is cooled to room temperature, and then heating to the temperature of the Ac_3 point or more is performed followed by quenching or air cooling; or

c) after the cooling steps of (a) or (b), a low temperature tempering is performed, i.e., 400 °C or lower.

CLAIMS 1-4 and 13-16

General

The rejection of the claims is based on the contention that the claimed composition is obvious, that the level of hardness could be optimized in the claimed range, the amount of carbides is inherent in the applied prior art. It is submitted that Lena does not establish a *prima facie* case of obviousness against claims 1-4 and 13-16 and the rejection must be withdrawn.

What the Examiner has done in the rejection is compartmentalize the invention into a series of obviousness conclusions, while at the same time failing to appreciate the overall impact of claims. In effect, the Examiner has concluded that because Lena teaches a composition which arguable overlaps that which is claimed, the entire invention is obvious. This fails to take into account that the invention is more than an adjustment in the process of Lena. It involves not only control of the composition, but also control of the processing to create a steel which has a hardness not achieved in the prior art materials relating to the invention, as well as improved resistance to sulfide stress corrosion cracking. Taking into account all of the claims limitations in claims 1-4 and 13-16, the routineer cannot get to the invention without first knowing what is contained in Applicants' disclosure. For example, why specify a particular hardness range, and particular value range based on the amounts of Mo and Cu, and a particular level of carbides at the grain boundaries? Lena lacks any teaching regarding control of these variables in the context of improving resistance to sulfide stress corrosion cracking, and the Examiner cannot use Lena alone to say that the limitations found in claims 1-4 and 13-16 are obvious variants of this reference. In fact, Lena is not even concerned with the problem faced by the inventors. Instead, Lena seeks to find a steel that has the best properties of both 300 and 400 series steels, and does this by forming a duplex structure, such a structure far afield of the invention. Thus, it is submitted that when considering the invention as a whole, the limitations found in claims 1-4 and

13-16 are not within the skill of the art and they, in fact, define true invention in the field of 13% Cr martensitic steels. Thus, the rejection based on Lena should be withdrawn.

It is also argued that claims 13-16 are even more removed from Lena on the grounds that Lena does not teach copper and molybdenum amounts that are effective as claimed as well as a structure resulting from one of the three processing sequences recited in the claim. As mentioned above, it is the presence of the Cu and Mo which enable the film layer of sulfides to be formed to enhance the resistance to sulfide stress corrosion cracking and the processing that produces not only the hardness but also the claimed amounts of carbides. Again, Lena does not teach or suggest an steel as delimited by claims 13-16 and these claims are clearly patentable over the applied prior art.

More specific arguments are made below regarding the specific limitations found in the claims.

Hardness

In the rejection, the Examiner admits that Lena does not teach the claimed hardness, but contends that hardness is a function of composition and a result effective variable and one could optimize the hardness to the claimed range. Applicants submit that this contention is in error.

Hardness of the steel is not simply adjusting an alloy composition as alluded to by the Examiner. It is well known in the metallurgical arts that hardness is not only achieved by adjusting the composition of a steel, but also by optimal control of the heat treatment of the steel.

While Applicants do not dispute that one of skill in the art may want to control the hardness, the real question is whether the art leads one of skill to do so in the manner of the claimed invention. As mentioned above, the prior art was faced with a hardness upper limit in the field of 13% Cr steels. Applicants have discovered that by using the particular ranges of the claims and processing the steel according to the heat treatment described above (a-c) above, a hardness level can be obtained that enhances the resistance to corrosion, see pages 14 and 15 of the specification.

The real question here is how does the desired range of hardness originate so that the alleged optimization can occur. While Lena does seek improvements in corrosion resistance, hardness and ductility, the road to improvement is through control of Mo, Ni, and Cr and creation of a duplex structure, not the use of Cu as is required in the claims. In addition, Lena

employs a subzero cooling step instead of the double aging step used in the prior art, see col. 1, line 69 to col. 2, line 26.

It is contended that Lena is focused on a different composition and different heat treatment method, and does not even recognize the problem of sulfide stress corrosion cracking. Thus, how does Lena arrive at the claimed composition and claimed hardness range? There is no basis to conclude that one of skill in the art would even be led to an optimization of hardness for a composition as claimed and Lena cannot obviate this aspect of the claims.

Claims 1-4 and 13-16 are further distinguished from Lena in that Lena is drawn to a different structure, which precludes the Examiner from concluding the same steel structure is being optimized to achieve the claimed level of hardness. Lena describes in col. 11, lines 42-57 that the steel has a duplex structure of islands of ferrite surrounded by a matrix of tempered martensite. This is attained by Lena's processing, which includes a subzero cooling, which is unique to Lena and produces a unique structure. According to the invention, the carbide amount and hardness are a function of the processing of (a-c) above, which is entirely different from that disclosed by Lena. This difference in structure further weakens the contention that one of skill in the art is merely optimizing the hardness of a material which is the same as that claimed. In fact, the Lena steel and that claimed are not the same.

Claims 13-16 are even more removed from Lena since they define a particular structure as a result of the processing of (a-c) above.

Carbide Amount

In the rejection, the Examiner points to col. 11, lines 42-57 to support the contention that the claimed carbide amount is found in Lena. While Lena may suggest the absence of carbides, this is in the context of a completely different material. As pointed out above, Lena teaches a duplex material, which is not that which is claimed. In the invention, the elimination of the tempering treatment or tempering at such a temperature that the $M_{23}C_6$ carbides are not precipitated is a key feature in increasing the resistance to sulfide stress corrosion cracking. This processing and results are not found in Lena, and the Examiner is incorrect in alleging that the claimed limitation is found. The structures of the steel of claims 1-4 and 13-16 are not the same as Lena and the allegation that the claimed carbide amount is present is improper when taken out of the context of the Lena structure. Even if the Lena structure was devoid of carbides at the

grain boundaries, this alone does not meet the limitations of claims 1-4 and 13-16 since the structures are different.

Claims 13-16 are further distinguished from Lena on the grounds that a structure is defined in terms of the processing of (a-c) as outlined above. Lena does not teach a martensitic stainless steel with the claimed structure as a result of such processing, and cannot obviate these claims.

Composition

In the rejection, the Examiner contends that Lena establishes a *prima facie* case of obviousness based on overlap in the composition. It is contended that the claimed composition is not an obvious variant of Lena's composition. Lena does not teach that copper is a critical element of the composition. At best, Lena treats copper as an impurity, see col. 2, lines 55-60, with a maximum of 0.25%. This is far afield from specifying a lower limit of copper but also a value range determined by the amount of copper as is required by each claim. Without a recognition of the importance of copper how does one of skill in the art decide to add copper to the composition of Lena. There is no reason to do so and the Examiner is engaging in the hindsight reconstruction of the prior art in light of the Applicants' disclosure.

It is also noted that Lena is really concerned with higher levels of Cr than the instant invention exemplifying in Table II levels that are outside the claimed range. While it is true that Lena teaches a range of 12-18% for Cr, the question remains as to whether one of skill in the art is led to use a range of 9-15%. Since the invention really addresses what is known as 13% Cr steels primarily for oil well use, and Lena is really seeking a cross between the 300 and 400 series stainless steel materials, it is asserted that the motivation to modify Lena in terms of the Cr content is also lacking.

For these reasons, Lena cannot be said to suggest the composition of claims 1-4 and 13-16 and the rejection should be withdrawn.

Claims 13-16 are also patentable since Lena does not teach copper and molybdenum amounts that form the claimed layer to work with the formed Cr oxide layer for improved corrosion resistance. Again, Lena treats copper as an impurity. With this, how could copper be employed in Lena to form with Mo the claimed film and provide the desired improvements in resistance to sulfide stress cracking corrosion? There is no basis to draw this conclusion and the rejection is flawed in light of this limitation.

Comparative Evidence

Applicants also wish to again point to the comparison made in the application regarding the improvements, particularly to Tables 2 and 3. These results show that steels having values outside the claimed values for hardness, and that do not abide by the formula and processing conditions do not perform as well as those that abide by the claim limitations. If fact, what this comparison shows is that achieving the range of hardness is not something that can be routinely done, and to characterize the hardness range as merely an optimization is improper.

The improvements in the corrosion resistance are unexpected, particularly over the teachings of Lena, which does not even address the problem faced by the inventors let alone the solution. Thus, even assuming that Lena could somehow establish a *prima facie* case of obviousness, the criticality regarding the claim limitations is clearly put forth in Tables 2 and 3 of the specification and this showing rebuts any such contention of obviousness and mandates withdrawal of the rejection.

CLAIMS 5-8 and 17-20

It is contended that these claims are patentable by virtue of the fact that they include the limitations of claims 1-4 and 13-16.

SUMMARY

By this amendment, it is respectfully submitted that each of claims 1-4 and 13-16 are patentable over Lena on the grounds that there is no objective basis in fact to assert that the limitations found in these claims are obvious variants of Lena. Alternatively, any allegation of obviousness is rebutted by the comparison made in the application.

Accordingly, the Examiner is respectfully requested to examine this application in light of this amendment, and pass claims 1-8 and 13-20 onto issuance.

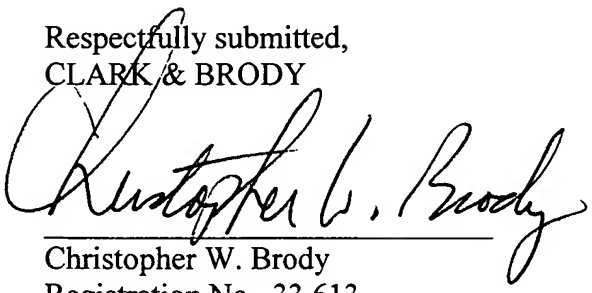
If the Examiner believes that an interview with Applicants' attorney would be helpful in expediting prosecution of this application, the Examiner is respectfully requested to telephone the undersigned at 202-835-1753.

Again, reconsideration and allowance of this application is respectfully requested.

A petition for a two month extension of time is hereby made. A check in the amount of $2850.00 is enclosed to cover the 12 extra independent claims and the two month extension.

Please charge any fee deficiency or credit any overpayment to Deposit Account No. 50-1088.

Respectfully submitted,
CLARK & BRODY



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